CLAIMS

I claim:

1. A rational harmonically mode locked, phase locking resonator comprising a birefringent beamsplitter adapted for use in an intracavity interferometer, the birefringent beamsplitter further comprising:

a. an uncoated, birefringent plate with P-polarization at a first surface; and

b. a high-reflectance S-polarization at a second, beamsplitter surface.

2. The rational harmonically mode locked, phase locking resonator of claim 1 wherein the phase locking resonator is at least one of (i) a Michelson-interferometer phase locking resonator or (ii) a Fox-Smith-interferometer phase locking resonator.

3. The rational harmonically mode locked, phase locking resonator of claim 1 wherein the P-polarization is low-loss.

4. A rational harmonically mode locked, compound-interferometer phase locking resonator comprising a birefringent beamsplitter adapted for use in an intracavity interferometer, the birefringent beamsplitter further comprising:

a. an uncoated, birefringent plate with P-polarization at a first surface; and

b. a high-reflectance S-polarization at a second, beamsplitter surface.

5. The rational harmonically mode locked, compound-interferometer phase locking resonator of claim 4 wherein the P-polarization is low-loss.

6. The rational harmonically mode locked, compound-interferometer phase locking resonator of claim 4 wherein the compound-interferometer phase locking resonator is at least one

of (i) a Fox-Smith-Fox-Smith compound interferometer, (ii) a Michelson-Michelson compound interferometer, or (iii) a Fox-Smith-Michelson compound interferometer.

7. The rational harmonically mode locked, phase-locked, resonator of claim 6 wherein the Fox-Smith interferometer is tuned so as to minimize a cavity loss for a single hypermode, wherein the Fox-Smith interferometer comprises a free-spectral range which is any integral or rational multiple of a radio frequency (rf) being used with the Fox-Smith resonator.

8. The rational harmonically mode locked, phase-locked, resonator of claim 6 wherein the Michelson interferometer is tuned so as to minimize a cavity loss for a single hypermode, wherein the Michelson interferometer comprises a free-spectral range which is any integral or rational multiple of a radio frequency (rf) being used with the Michelson resonator.

9. The rational harmonically mode locked, phase-locked, compound-interferometer resonator of claim 6 in which the interferometers are tuned so as to select a single hypermode, wherein the interferometers comprise a free-spectral range which are any integral or rational multiple of a radio frequency (rf) being used with the resonators.

10. The rational harmonically mode locked, phase-locked, compound-interferometer resonator of claim 6 in which the free-spectral range of the Michelson interferometer is equal to the rf frequency, and the free-spectral range of the Fox-Smith interferometer is the smallest of the values for which the slowest decaying hypermode is the hypermode adjacent to the surviving hypermode.

11. A method of obtaining a rational harmonically mode locked, phase-locked, compound-interferometer resonator, comprising:

a. providing a rational harmonically mode locked, phase locking resonator comprising a birefringent beamsplitter adapted for use in an intracavity interferometer, the birefringent beamsplitter further comprising:

i. an uncoated, birefringent plate with P-polarization at a first surface; and

ii. a high-reflectance S-polarization at a second, beamsplitter surface; and

b. coupling non-integral harmonic mode locking with the rational harmonically mode locked, phase-locked, compound-interferometer resonator.

12. The method of claim 11 wherein the method is adapted for use with at least one of (i) a mode locked laser, (ii) a free-electron laser, or (iii) a harmonically mode locked laser.